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Abstract

PRACTICAL RESULTS AND PROSPECTS OF THE USE OF SOLUBLE POISON IN THE PRESSURIZED WATER REACTORS.

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The control by chemical shim is going to play an important role in the economics of pressurized water reactor operation. The homogeneous poisoning of the primary circuit water, avoiding the perturbating action of the control rods authorizes a more uniform distribution of the neutron flux; it opens the way towards a large initial investment of reactivity, and that way leads to an increase of the core life time.

The chemical shim is provided in the pressurized water plants being presently erected of planned; it will compensate for the fuel burn-up and follow the slow transients, such as those resulting from the xenon effect. The combination of the neutronic and chemical properties of the boric acid designated it as poison.

The present paper covers, in the first part, the problems encountered during the power operation of the BR-3 plant, in presence of boron and, in the second part, the influence of this type of control on the design and the operation of the pressurized water type plants, as well as in the treatment of radioactive wastes.

A. Power operation of the BR-3 plant with boron in the primary loop.

After analog computer studies and preliminary tests proved that a power operation in presence of boron was safe, two series of tests were run

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successively ; the first one with 125 ppm, the second one with 350 ppm of boron (in boric acid form) dissolved in the water. Most practical cases have been covered :

- power operation at fixed load,
- operation at reduced load,
- slow and fast load transients,
- slow reactivity transients ; especially the xenon effect was followedwithout rod displacement.

The report describes some of the encountered problems, and gives with comments, the results of the tests, showing the evolution of the primary loop parameters (reactivity, water chemistry, activities).

B. Influence on the circuits

The introduction of the chemical shim did not radically modify the auxiliary circuits of the reactors presently under design. However, it seems interesting to review the hydraulic circuits, as a whole,especially the purification and the waste treatment system.

Some solutions to the purification system problem are discussed in connection with the various methods of boric acid removal.

Furthermore, feed and bleed needed for boric acid dilution, increase the quantities of liquid wastes. The paper discusses the problem of the boric acid removal, either by concentration and separation (different methods are suitable : single effect evaporation or compression evaporation, demineralization, electrodialysis, precipitation ...), or by controlled rejection, after storage and dilution.

The economical aspect is also considered.